# MERGING CONTROL PANEL IMAGES

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## TECHNICAL FIELD

The present disclosure relates to displaying images on a device control panel, and more particularly, to merging various device images into a system image for display on a control panel.

## BACKGROUND

Printing devices, such as laser printers, are often combinable with other external devices in order to facilitate the overall task of document preparation. For example, an external storage device can be attached to a high-speed laser printer as a paper input device to reduce the frequency with which the printer needs to be reloaded with paper. A high speed laser printer that prints 50 pages per minute might otherwise quickly run out of paper even though it has two embedded, 500 page input trays. An external output device might also be attached to the printer as a document finishing device. Such output devices can function as paper sorters, paper stackers and paper binders. A stapler/stacker output device might offer various ways of stapling documents together such as placing staples down the side of a document, or placing a staple in the corner of a document at different angles. **Fig. 1** illustrates an example of a printing system that includes a printing device **100**, an input device **102**, and an output device **104**.

Printing devices often include control panels that provide various information to help users operate the devices. Among other things, a control panel can display images that help a user locate and manage problems that arise during the printing process. For example, when there is a paper jam in a printer, the printer's control panel typically displays an image of the printer that indicates

where the jam is located and which door to open up to remove the jam. The image may illustrate the printer from a certain angle and include an animation of a particular door opening and closing in order to better help a user locate the paper jam.

Most printing device control panels can also display an image of an external device that is attached to the printing device. Therefore, if a paper jam occurs in the external device, the control panel might display an image of the external device to assist a user in locating and fixing the jam. **Fig. 2** illustrates an example of a control panel **200** displaying an image of a paper input device **202** in a conventional printing system such as that shown in **Fig. 1**. The image **202** indicates where a paper jam is located and which door a user should open to access the paper jam.

Although displaying an image of the input device on the control panel is helpful in locating and fixing an error such as a paper jam, current methods of displaying these images have disadvantages. This is because conventional printing device control panels generally display devices in isolation from the rest of the system to which the devices are attached. Thus, a displayed device image illustrates only one part of an overall printing system. This type of image display can be problematic for inexperienced users.

For example, it can be difficult for a casual user to discern where a printer ends and where another device begins on a complex printing system that includes external devices such as input paper storage devices and output document finishing devices. Therefore, when a printer's control panel displays only the image of an input device to help a user remedy a paper jam, the user can be confused as to precisely where to look on the system to find the paper jam. The display of an input device by itself lacks context with respect to the overall printing system. The printing system typically includes numerous access doors,

each having a similar appearance, that are located at various places on both the printer and its external devices.

Thus, an inexperienced user may have trouble understanding an image of a single device being displayed outside the context of the overall system to which the single device is attached. This can result in difficulties and delays for casual users wanting to correct problems such as paper jams encountered while operating a printing system.

Other disadvantages with current methods of displaying external device images on a printer's control panel relate to maintaining an updated library of images either on the printer or on the external device. Some external devices store images that include the external device and the printer for which the external device was designed. Conversely, some printers store images that include the printer and various external devices that have been designed for use with the printer. Therefore, a printer can display system images that include both the printer and an external device. However, these images do not include any other external devices that may be attached to the printer as part of the overall system. Furthermore, as new external devices are developed for use with a particular printer, it becomes increasingly difficult to update and maintain a library of images on the printer that adequately accounts for the new external devices. Similarly, as new printers are developed that are capable of functioning with existing external devices, external device image libraries are rarely updated to include the newly developed printers. Therefore, external devices often provide images that do not adequately represent a newly developed printer to which the external device may be attached.

Accordingly, the need exists for a way to merge various images from different devices that are part of a printing system so that a control panel can display a comprehensive image that includes all the devices in the system

without the need for updating image libraries each time a new printer or a new device is introduced.

## SUMMARY

Images from various devices in a printing system are combined in order to display an overall system image on a control panel of a printing device. Events in a printing system are associated with particular event codes. For example, an error event such as a paper jam in a printing device or other device coupled to the printing device is associated with a particular error code. When an event occurs, a printing device receives an associated event code. Based on the event code, the printing device merges images from one or more external devices with an image of itself. The merged image makes up an overall printing system image that is displayed on a control panel of the printing device. The system image provides information to a user about the nature and location of the event.

In one embodiment, a printing device retrieves external device images upon initialization of the printing system. Appropriate images are then merged as a system image and displayed on a control panel once an event code is received. In another embodiment, a printing device retrieves external device images after receiving an event code and merges the images for display on a control panel. Further embodiments include a printing device that receives an event code from its own sensors which detect an event on the printing device, and a printing device that receives an event code from an external device attached to the printing device.

## BRIEF DESCRIPTION OF THE DRAWINGS

The same reference numbers are used throughout the drawings to reference like components and features.

**Fig. 1** illustrates an example of a printing system that includes a printing device, an input device and an output device.

**Fig. 2** illustrates a control panel on a printing device displaying an image of an external device as it would appear in the prior art.

**Fig. 3** illustrates a system environment that is suitable for merging control panel images.

**Fig. 4** illustrates examples of printing devices that might be part of a printing system within a system environment such as that shown in **Fig. 3**.

**Fig. 5** is a block diagram illustrating in greater detail, an exemplary embodiment of a host computer and printing system devices such as those shown in **Fig. 3**.

**Fig. 6** illustrates examples of how a typical input device, output device, and printing device might appear in isolation from one another.

**Fig. 7** illustrates a view of an input device such as that shown in **Fig. 6** from an angle that shows its front and side.

**Fig. 8** illustrates a control panel on a printing device displaying a merged printing system image.

**Fig. 9** is a flow diagram illustrating an example method of merging control panel images.

**Fig. 10** is a flow diagram illustrating an alternate example method of merging control panel images.

## DETAILED DESCRIPTION

The system and methods described herein relate to merging images on a control panel of a printing device so that an image displayed in the control panel illustrates an entire printing system rather than just one component of that system. Advantages of the disclosed system and methods include more readily recognizable images displayed on control panels and an increase in the flexibility of device development due to a reduced need for updating device image libraries. The images generally provide increased information to a user about operating the printing system and correcting printing system errors.

### Exemplary System Environment For Merging Control Panel Images

**Fig. 3** illustrates a system environment that is suitable for merging control panel images. The system environment **300** of **Fig. 3** includes printing device **302** operatively coupled to a host computer **304** through a direct or network connection **306**. The system **300** may also include additional remote device(s) **308** coupled to printing device **302** and host computer **304** through network **306**. The direct or network connection **306** can include, for example, a printer cable, a LAN (local area networks), a WAN (wide area networks), an intranet, the Internet, or any other suitable communication link.

This disclosure is applicable to various types of printing devices **302** capable of displaying images on a control panel. **Fig. 4** illustrates examples of printing device **302**. Printing device **302** can include various printing devices such as laser-based printers, ink-based printers, dot matrix printers, dry medium printers, plotters and the like. In addition, printing device **302** can include various multi-function peripheral (MFP) devices that combine a printing function with other functions such as faxing, scanning, copying and the like.

Host computer **304** and remote device(s) **308** can be implemented as a variety of general purpose computing devices including, for example, a personal computer (PC), a server, a Web server, and other devices configured to communicate with printing device **302**. Host computer **304** typically provides a user with the ability to manipulate or otherwise prepare in electronic form, an image or document to be rendered as an image that is printed or otherwise formed onto a print medium by printing device **302** after transmission over network **306**. In general, host computer **304** outputs host data to printing device **302** in a driver format suitable for the device **302**, such as PCL or PostScript. Printing device **302** converts the host data and outputs it onto an appropriate recording media, such as paper or transparencies.

The system environment **300** of **Fig. 3** also includes, as part of a printing system **310**, one or more external devices operatively coupled to printing device **302**. The external devices can include devices such as an input device **312** and an output device **314**. Thus, printing system **310** of **Fig. 3** typically includes printing device **302** and one or more external devices such as input device **312** and output device **314**. Input device **312** is typically an external paper storage device that is attached to printing device **302** to reduce the frequency with which printing device **302** needs to be reloaded with paper or provide paper input capabilities for paper sizes not supported by the internal trays of printing device **302**. Output device **314** is typically a document finishing device that provides document finishing functions such as paper sorting, paper stapling, paper stacking and paper binding. Output device **314** might offer various ways of stapling documents together such as placing staples down the side of a document, or placing a staple in the corner of a document at different angles.

**Exemplary System Embodiments For Merging Control Panel Images**

**Fig. 5** illustrates an exemplary embodiment of the system **300** in more detail. Host computer **304** includes a processor **500**, a volatile memory **502** (i.e., RAM), and a non-volatile memory **504** (e.g., ROM, hard disk, floppy disk, CD-ROM, etc.). Nonvolatile memory **504** generally provides storage of computer readable instructions, data structures, program modules and other data for host computer **304**. Host computer **304** may implement various application programs **506** stored in memory **504** and executed on processor **500** that create a document or image (e.g., text and graphics) on a computer screen that is transferred to printing device **302** for creating a hard copy of the document/image. Such applications **506** might include software programs implementing word processors, illustrators, computer-aided design tools and the like. Host computer **304** may also implement one or more software-based device drivers **508** stored in non-volatile memory **504** and executed on processor **500** to format document data into page description language (PDL) such as PostScript or printer control language (PCL) or another appropriate format which it outputs to printing device **302**. A device driver **508** might also be implemented on the specific device it is "driving", such as discussed below with respect to device driver **518** on printing device **302**.

Printing device **302** has a controller **510** that processes data from host computer **304**. The controller **510** typically includes a data processing unit or CPU **512**, a volatile memory **514** (i.e., RAM), and a nonvolatile memory **516**. Nonvolatile memory **516** can include various computer storage media such as ROM, flash memory, a hard disk, a removable floppy disk, a removable optical disk and the like. Nonvolatile memory **516** generally provides storage of computer readable instructions, data structures, program modules and other data for printing device **302**. Printing device driver module **518** is executable on

processor **512** to format host data into page description language (PDL) such as PostScript or Printer Control Language (PCL) or another appropriate format to control the output of printing device **302** through printer device engine **520**. Device driver **518** might also be implemented on host computer **304** as discussed above.

In the exemplary embodiment of **Fig. 5**, printing device **302** also includes merge module **522** and printing device images **524** stored in memory **516**. Merge module **522** executes on processor **512** to combine images from printing device **302** with images from other devices of printing system **310**. Merge module **522** operates in various ways to access and combine images as described in greater detail below. After merging images into an overall image of printing system **310**, merge module **522** displays the overall system image on control panel **526**.

Input device **312** and output device **314** are examples of external devices that might be attached to printing device **302** as part of printing system **310**. **Fig. 6** illustrates examples of how a typical input device **312**, output device **314**, and printing device **302** might appear in isolation from one another. Input device **312** typically includes a media storage/input device that provides large quantities of accessible print media to printing device **302** and/or provides paper input capabilities for various paper sizes not supported by the internal trays of printing device **302**. Thus, input device **312** supplements the print media supply typically available to printing device **302** through one or more media trays embedded in printing device **302**. This reduces the frequency with which printing device **302** needs to be reloaded with print media (e.g., paper) and increases the media alternatives available for printing device **302**.

Input device **312** typically includes controller **528** with a processor **530**, volatile memory **532** (i.e., RAM), and nonvolatile memory **534**. Memory **534**

includes input device images **536**. In general, controller **528** responds to input device **312** sensors (not shown) and printing device **302** instructions to control the output of input device **312** through input device engine **538**. Controller **528** communicates with printing device **302** through a device management language such as PML (printer management-information-base language) or any other language known by those skilled in the art. Generally, PML is a protocol for monitoring and controlling printer devices and their functions. PML is a subset language of SNMP (simple network management protocol) that defines printer device objects with decimal-separated strings that are used in command queries, for example, to obtain object values.

Output device **314** typically includes a document finishing device that receives printed media output from printing device **302** and puts it in a final form. Thus, output device **314** is typically a paper sorter, paper stacker, paper binder, or some combination thereof. Output device **314** might offer various ways of stapling documents together such as placing staples down one side of a document, or placing a staple in the corner of a document at different angles.

Like input device **312**, output device **314** includes a controller **540** with a processor **542**, volatile memory **544** (i.e., RAM), and nonvolatile memory **546**. Memory **546** includes output device images **548**. In general, controller **540** responds to sensors (not shown) and printing device **302** instructions to control the performance of output device **314** through output device engine **550**. Controller **540** communicates with printing device **302** through a protocol as described above.

In a first instance of the exemplary embodiment of **Fig. 5**, upon initialization of printing system **310**, merge module **522** is configured to communicate with input device **312** and output device **314** to facilitate the transfer of input device images **536** and output device images **548** to printing

device **302**. Thus, upon power-up of printing system **310**, for example, input device images **536** and output device images **548** are transferred to memory **516** on printing device **302**. Merge module **522** is then further configured in this instance to interpret and respond to event messages or event codes received from input device **312**, output device **314** and printing device **302**.

Generally, event messages or codes are generated by an input device **312**, an output device **314**, or the printing device **302** when there is a need to convey information to the user about some operational aspect of one or more of these system devices. Therefore, an event code can include an error code related to an error such as a paper jam that has occurred in a device, an information code related to a low paper supply in a paper tray in a device, and the like.

For example, an error message can be generated during a printing process which indicates that a device within the printing system **310** (i.e., the input device **312**, output device **314** or printing device **302**) has sensed a problem. The error message contains an error code that identifies the precise nature of the problem, such as a paper jam that has occurred at a particular location in the input device **312**. Each of the images stored as input device images **536**, output device images **548**, and printing device images **524** is associated with a particular event code. Thus, an error code defines appropriate device images for display on control panel **526** that will provide a user with information relevant to the error.

In the first instance of the exemplary embodiment of **Fig. 5** mentioned above, upon receiving, for example, an error message from a printing system **310** component (i.e., the input device **312**, output device **314** or printing device **302**), merge module **522** first responds by issuing an instruction to halt the printing process. Merge module **522** then interprets the error code and retrieves images from its memory **516** that are associated with the error code. The images can include various views of each of the input device **312**, the output device **314**, and

the printing device **302**. These device images can include views that are animated or that show the devices from specific angles or distances. **Fig. 7** illustrates a view of an input device **312** such as that shown in **Fig. 6** from an angle that shows the front and side. In addition, the image of **Fig. 7** is animated to show a side panel door opening and closing. Once the merge module **522** retrieves images defined by the error code, it merges them into one coherent image of the printing system **310** and displays this image on control panel **526**.

**Fig. 8** illustrates an example of a control panel **526** displaying an image of an overall printing system **310**. The image combines views of the input device **312**, the output device **314**, and the printing device **302** that correspond to show a particular angle and distance. In addition, the image displayed in the control panel **526** of **Fig. 8** is animated to show a side panel door opening and closing on the input device **312**. The displayed image showing the whole printing system **310** clearly indicates to a user where a paper jam has occurred and how to go about fixing the paper jam. Control panel **526(A)** on **Fig. 8** points out where on printing device **302** a control panel **526** might be located.

In a second instance of the exemplary embodiment of **Fig. 5**, input device images **536** and output device images **548** are not transferred to printing device **302** upon initialization of printing system **310**. Rather, merge module **522** is configured to retrieve the appropriate images from the input device **312**, the output device **314**, and the printing device **302** upon receiving an event message from one of these devices. Thus, during a printing process, an error message may be received from one of the devices containing an error code that indicates to the merge module **522** the precise nature of an error that has occurred. The merge module **522** then requests the appropriate images as defined by the error code from each of the input device images **536**, output device images **548**, and printing device images **524** that are stored respectively on the input device **312**,

the output device **314**, and the printing device **302**. Upon receiving the requested images, the merge module **522** merges the images into one coherent image of the printing system **310** and displays this image on control panel **526** as discussed above with reference to **Fig. 8**.

**Exemplary Methods For Merging Control Panel Images**

Example methods for merging control panel images will now be described with primary reference to **Figs. 9** and **10**. The methods apply generally to the exemplary embodiment of system **300** discussed above with reference to **Fig. 5**.

**Figs. 9** and **10** are flow diagrams that show examples of general methods for merging images of printing system devices on a control panel display of a printing device. Although **Figs. 9** and **10** and the following discussion pertain to an error event in a printing system **300**, this is not intended to limit the applicability of this disclosure to error events. Thus, the general disclosure of methods for merging images of printing system devices on a control panel display is applicable to any type of information event that might occur within a system such as printing system **300**.

At block **900** of **Fig. 9**, a printing device **302** receives an event message such as an error message that includes an error code. The error message has been generated by an external device to printing device **302** or by the printing device **302** itself. The error message generally indicates that an error event has occurred in a printing system **310** device during a printing process that requires information to be conveyed to the user through a control panel **526** in printing device **302**.

At block **902**, the printing device **302** generates and sends an instruction to halt the printing process. At block **904**, the printing device **302** sends an instruction requesting images from each external device based on the error code

received in the error message at block **900**. At block **906**, the printing device **302** receives one or more images from each external device. At block **908**, the printing device **302** combines the images with a printing device image to form an overall image of printing system **310**. At block **910**, the printing device **302** displays the image of the printing system **310** on a control panel of the printing device **302**.

**Fig. 10** is a flow diagram illustrating an alternate example method of merging control panel images. At block **1000**, a printing device **302** is initialized. Initialization typically occurs as a printing system **310** is being powered up. At block **1002**, images are received by the printing device **302** from external devices attached to the printing device **302** as part of printing system **310**. At block **1004**, printing device **302** receives an error message that includes an error code. The error message has been generated by one of the external devices or by the printing device **302**. The error message generally indicates that a problem has occurred in a printing system **310** device during a printing process.

At block **1006**, the printing device **302** generates and sends an instruction to halt the printing process based on the error message. At block **1008**, based on the error code received in the error message at block **1004**, the printing device **302** combines some of the received images with a printing device image to form an overall image of printing system **310**. At block **1010**, the printing device **302** displays the image of the printing system **310** on a control panel of the printing device **302**.

Although the description above uses language that is specific to structural features and/or methodological acts, it is to be understood that the invention defined in the appended claims is not limited to the specific features or acts described. Rather, the specific features and acts are disclosed as exemplary forms of implementing the invention.